

# Reducing the Read Noise of HAWAII-2RG Detector Systems with Improved Reference Sampling and Subtraction (IRS<sup>2</sup>)

Bernard J. Rauscher<sup>a</sup>, Richard G. Arendt<sup>b</sup>, D.J. Fixsen<sup>c</sup>, Matthew Lander<sup>f</sup>, Don Lindler<sup>d</sup>, Markus Loose<sup>e</sup>, S. H. Moseley<sup>a</sup>, Donna V. Wilson<sup>f</sup>, and Christos Xenophontos<sup>f</sup>

<sup>a</sup>Code 665, NASA Goddard Space Flight Center, Greenbelt, MD

<sup>b</sup>CRESST/UMBC/GSFC, Greenbelt, MD

<sup>c</sup>CRESST/UMd/GSFC, Greenbelt, MD

<sup>d</sup>Sigma Space Corporation/GSFC, Greenbelt, MD

<sup>e</sup>Markury Scientific, Inc., 518 Oakhampton Street, Thousand Oaks, CA

<sup>f</sup>Code 582, Goddard Space Flight Center, Greenbelt, MD

## ABSTRACT

IRS<sup>2</sup> is a Wiener-optimal approach to using all of the reference information that Teledyne's HAWAII-2RG detector arrays provide. Using a new readout pattern, IRS<sup>2</sup> regularly interleaves reference pixels with the normal pixels during readout. This differs from conventional clocking, in which the reference pixels are read out infrequently, and only in a few rows and columns around the outside edges of the detector array. During calibration, the data are processed in Fourier space, which is close to the noise's eigenspace. Using IRS<sup>2</sup>, we have reduced the read noise of the James Webb Space Telescope Near Infrared Spectrograph by 15% compared to conventional readout. We are attempting to achieve further gains by calibrating out recently recognized non-stationary noise that appears at the frame rate.

**Keywords:** HAWAII-2RG, H2RG, SIDECAR, noise, read noise